Stock Assessment of Blue Sharks in the North Pacific

An example of a 'data poor' international shark stock assessment

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Presentation 12.2

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Southwest Fisheries Science Center

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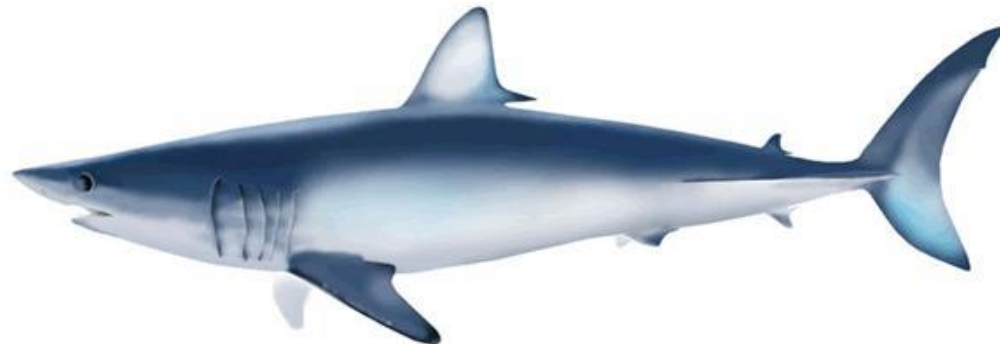
Development of the assessment

- ISC Shark WG (met in Japan & USA: 2011-2013)
  - Develop and review catches by nation
  - Develop and review abundance indices
  - Review biological data
- USA, Japan, Chinese-Taipei, Mexico, Canada, IATTC, SPC, Korea, China
- Bayesian surplus production model (BSP)
  - Chosen based on knowledge of available data
  - Single stock (N. Pacific)
  - Uncertain catch & high bycatch
  - Catch & CPUE: 1971-2011
  - Size, growth, sex, tagging data not included
- Previous assessment (Kleiber et al 2009)
 - BSP and age-structured models

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Fisheries in North Pacific
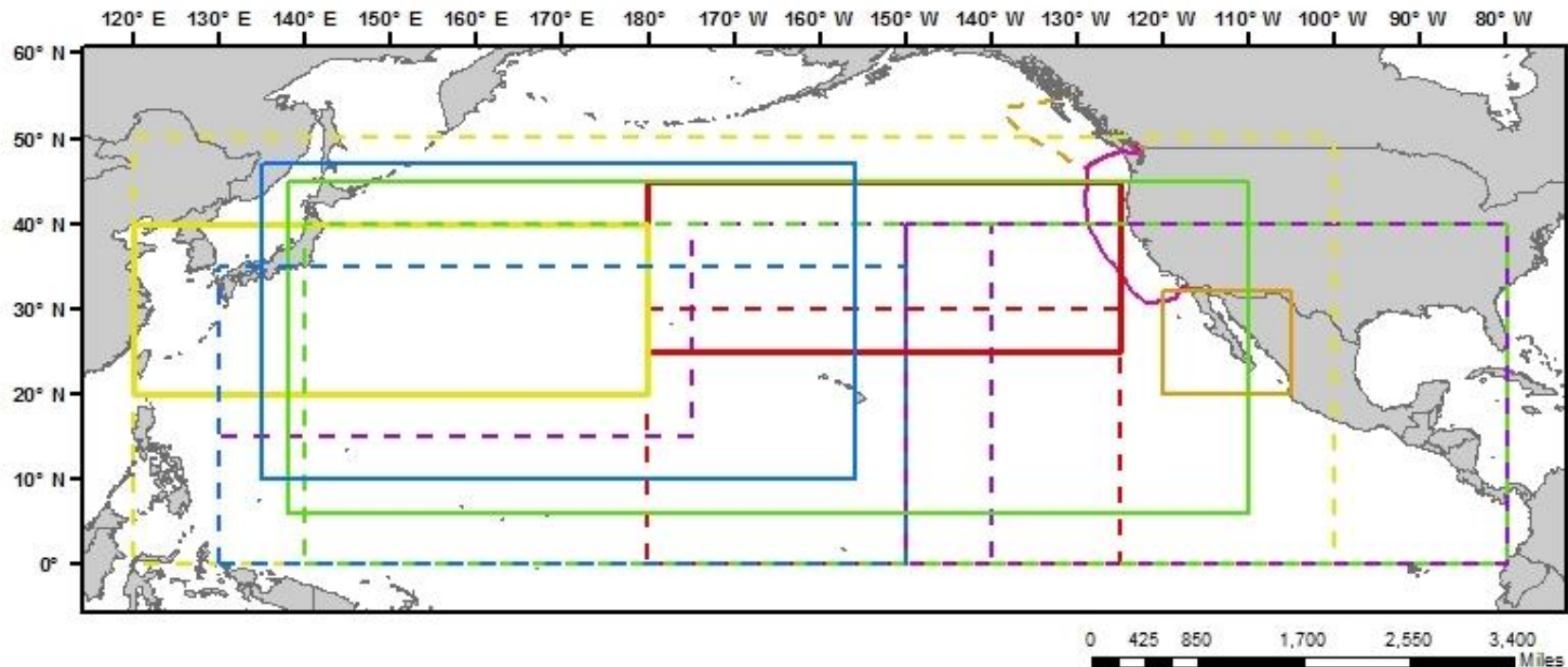
Legend

- ——— Japan Kinkai shallow longline
- – – – Japan Kinkai deep longline
- ——— Japan Enyo shallow longline
- – – – Japan Enyo deep longline
- ——— Taiwan small-scale longline
- – – – Taiwan distant-water longline
- ——— Mexico longline/driftnet
- ——— Hawaii shallow longline
- – – – Hawaii deep longline
- ——— USA drift gillnet
- – – – SPC non-member longline
- ——— IATTC member purse seine
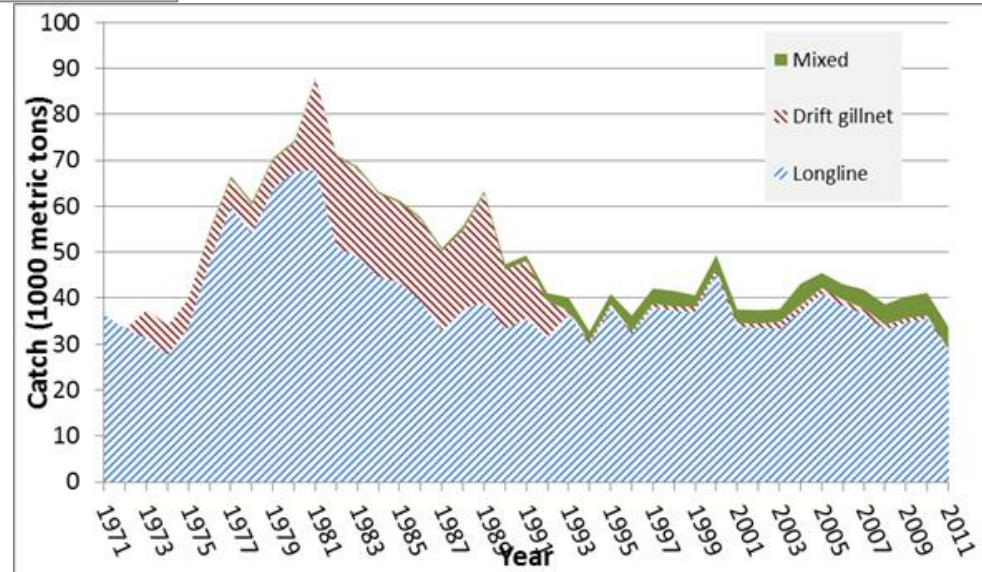- – – – Canada trawl/longline

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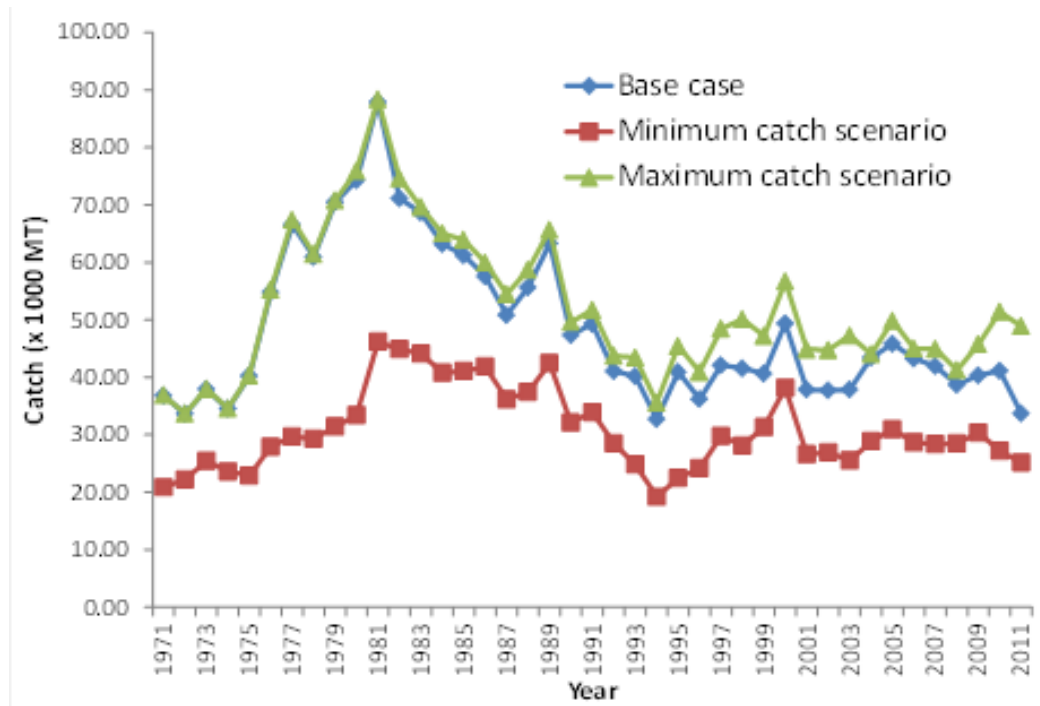
Catch by country and gear
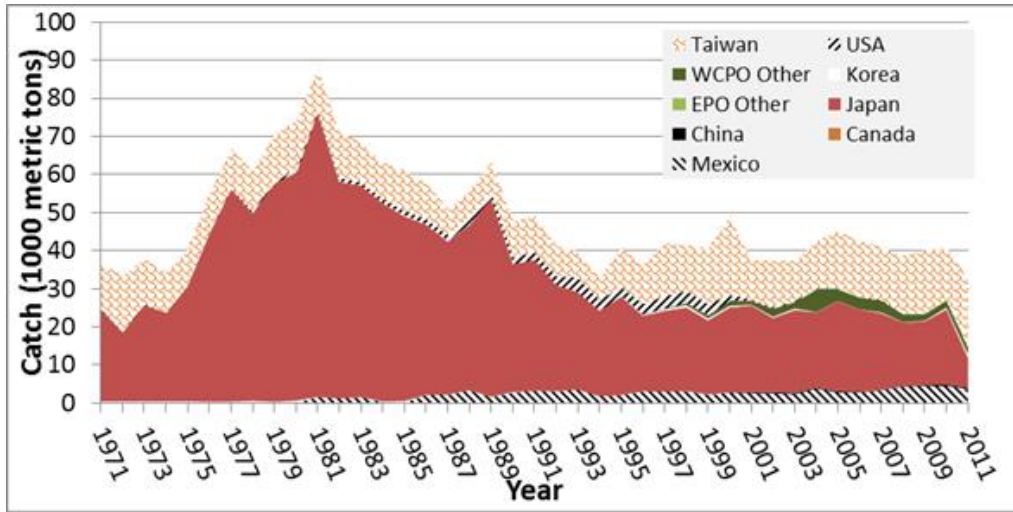
Japan: 68%
Taiwan: 24%
Mexico: 4%
Others: 4%

Longline: 82%
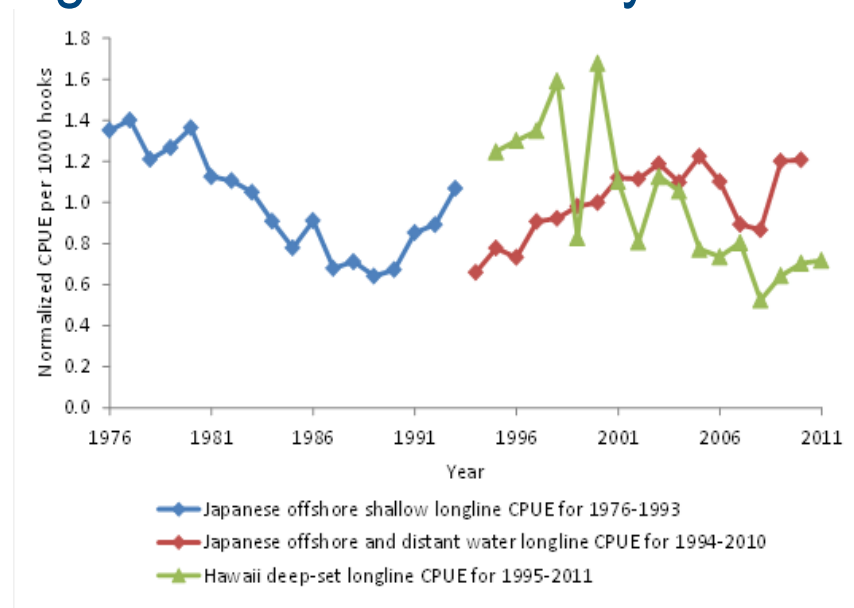Drift gillnet: 14%
Others: 4%

Catch scenarios

- Catches by fishery & nation provided with base case and alternative discard mortality scenarios (Hi: 100% mortality / Low: 0% mortality)

CPUE Indices

- Seven candidate CPUE indices developed & evaluated based on common criteria (diagnostics, spatio-temporal coverage, etc.)

- Four were rejected by WG (poor diagnostics, inadequate spatial/temporal coverage)

- Three included

  - Base case: Japanese shallow longline "Kinkai" and "Enyo"
    - Early: 1976-1993
    - Late: 1994-2010

  - Alternative: Hawaii deep-set
    - 1995-2011
    - Good diagnostics & temporal coverage
   - Small portion of catch & spatial scale

Legend:
- Japanese offshore shallow longline CPUE for 1976-1993
- Japanese offshore and distant water longline CPUE for 1994-2010
- Hawaii deep-set longline CPUE for 1995-2011

Results: biomass trend

- Not overfished and overfishing not occuring
- Exceeded MSY from early 1980's to early 1990's
- Current (2011) ~ 1.5 x B_{msy}
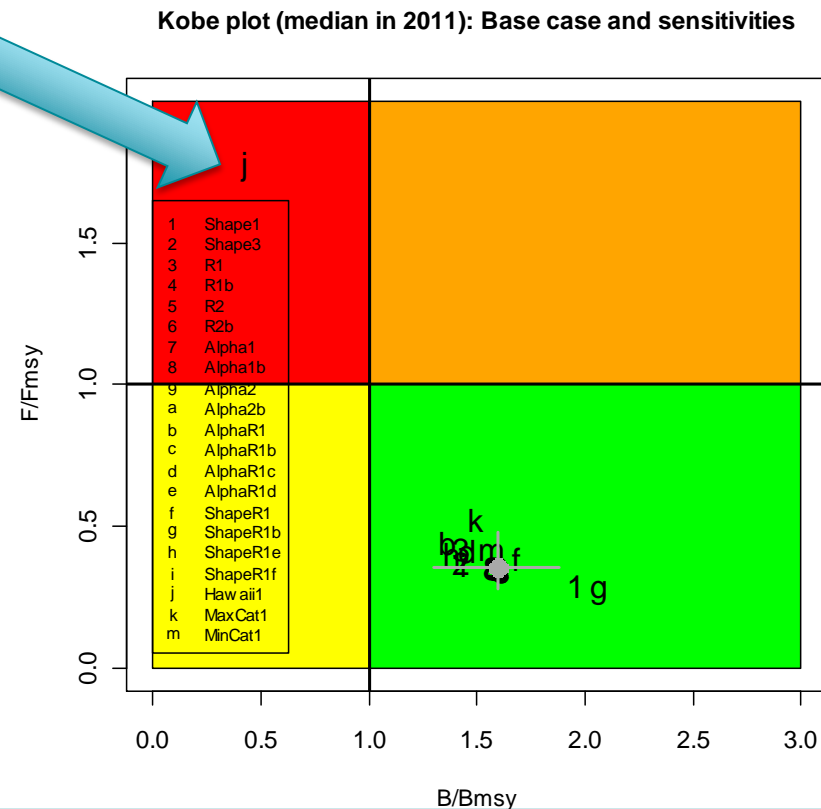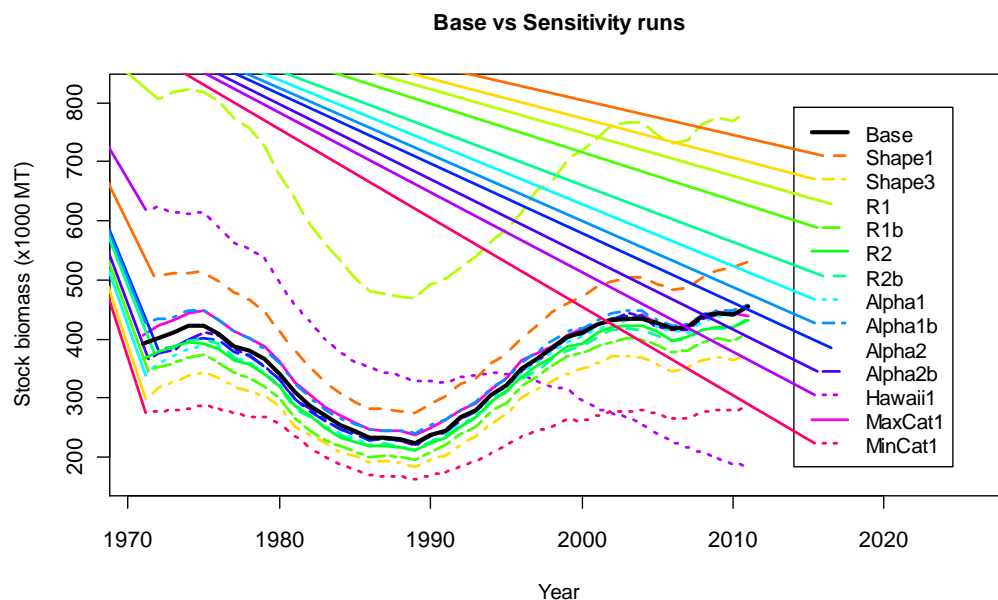

Kobe plot (median): Base case
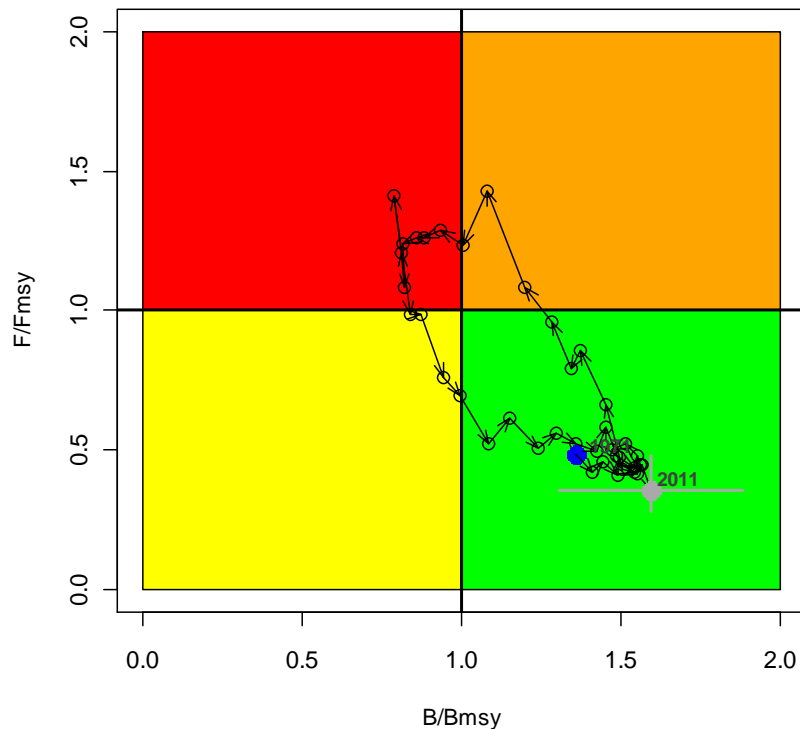
Base case, 1971-2011
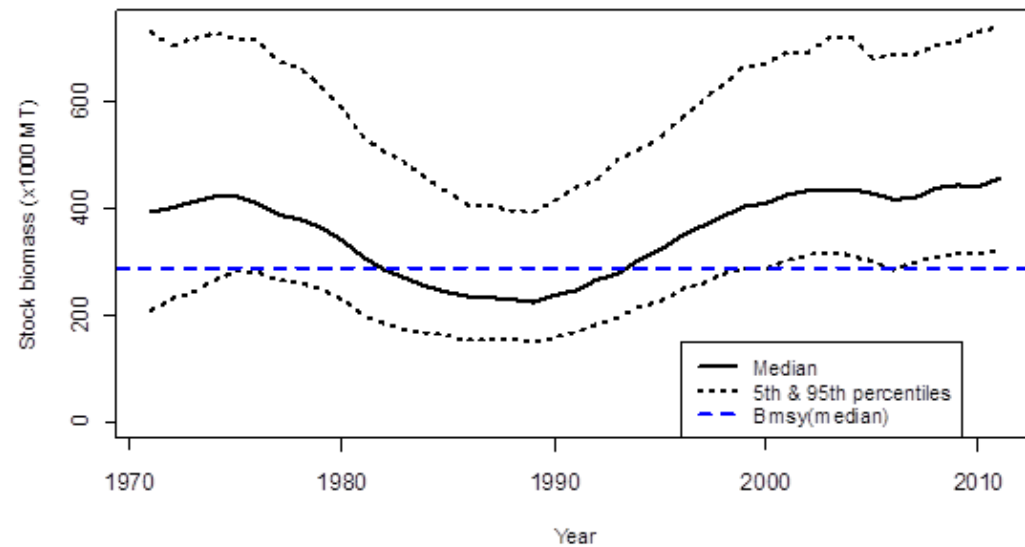
Sensitivity analysis

- Mostly robust to alternative parameter and Hi/Low catch scenarios
- Exception: Hawaii CPUE index (declining trend) results in very pessimistic stock status
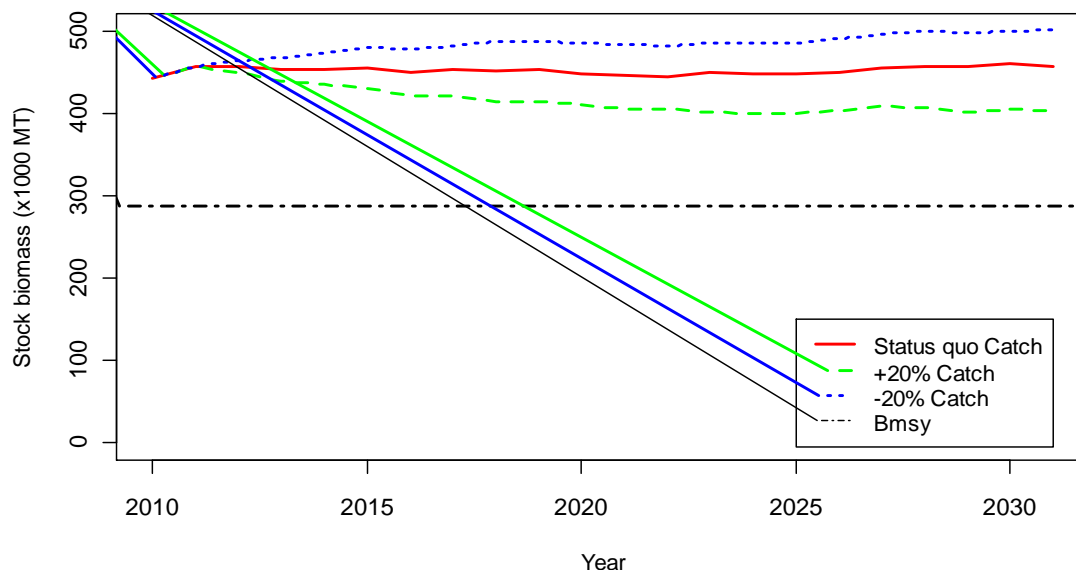

Base vs Sensitivity runs

Kobe plot (median in 2011): Base case and sensitivities

20 Year Biomass Projections for Base Case

- Under various catch policies: status quo catch is the 2006-2010 average
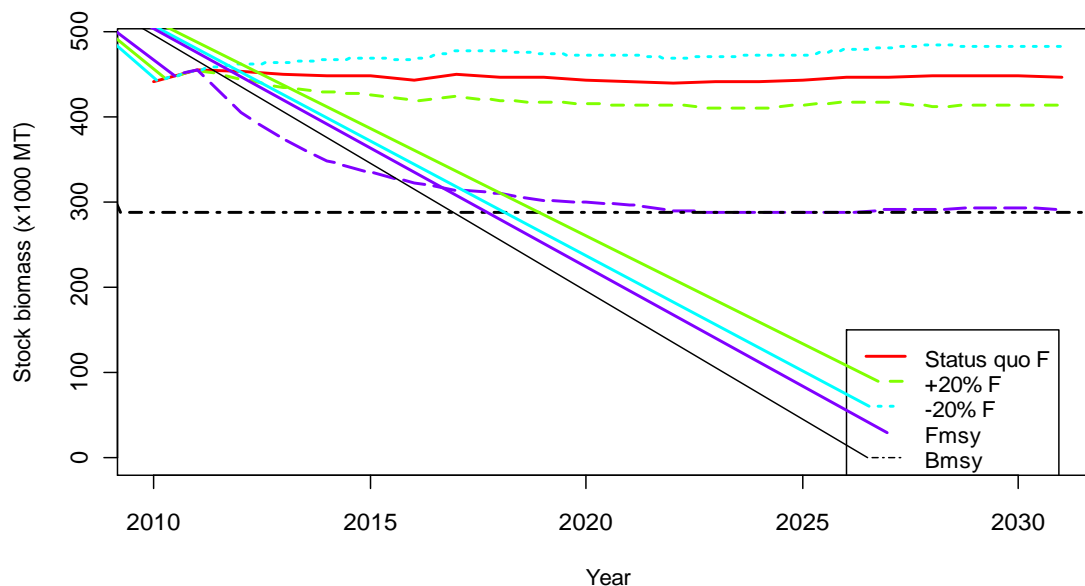
- Under various *F* policies: status quo F is the 2006-2010 average

Projection (median trajectory) - Base case

Legend:
- Status quo Catch
- +20% Catch
- -20% Catch
- Bmsy

Projection (median trajectory) - Base case, const F and Fmsy

Legend:
- Status quo F
- +20% F
- -20% F
- Fmsy
- Bmsy

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Strengths and Challenges

Strengths

- Model robust to most plausible scenarios
- Data informative to model parameters and results (eg. results not overly driven by parameter assumptions)
- No major conflict with previous assessment found
- New catch data (Mexico, W. Coast USA, Canada)

Challenges

- Uncertainty in biological data (age-growth, spatial structure, movement)
- CPUE indices require more consideration (Hawaii and RTV indices)
- Better catch data (eg China): much derived from product of CPUE and effort (ie. catch not estimated independently).
- More catch data: No catches currently available from C. America
- Relative to other sharks, blue shark are 'data rich'. Less and lower quality data likely for other shark assessments (ie. mako, etc.)

Strategies for improvement

- Age-sex structured model would better represent population dynamics

- Shark WG will continue age-growth research

- Size data would help

- Work with C. American & China to get more catch data

- Ongoing improvement to abundance indices (including Japan RTV)

- Spatial structure (Seki-Nakano hypothesis)